Hip arthroplasty in the very elderly

Valorisation

This paragraph intends to discuss the social and economic value of the results described in this thesis. Part of it has been discussed in further detail in chapter 8 (General discussion).

This thesis aimed to investigate the role of 1) proximal femoral morphology, 2) femoral stem design and fixation, and 3) the orthopaedic surgeon, in hip arthroplasty in very elderly patients. The goal of hip arthroplasty is to reconstruct the native hip joint as anatomical and durable as possible with a minimal chance on complications and maximum patient satisfaction. In this thesis it was shown that the morphology of the proximal femur continues to change in very elderly patients aged 80 years and older. This age group mostly consists of elderly patients with multiple comorbidities and limited physical reserves which make them a frail patient group. There is an ongoing trend to use cementless instead of cemented stems, most likely because of the slightly shorter operating time (approximately 10 minutes). However, cementless stems are in general more expensive and lead to more implant-related complications such as periprosthetic fractures and aseptic loosening when used in elderly femora. In particular in the frail elderly, who were subject of study in this thesis, it is of utmost importance to minimize the chance on complications and even revision surgery. Based on the findings described in chapter 2 it was demonstrated that even beyond the age of 80 years the morphology of the proximal femoral canal continues to change into a stovepipe shape and that the proximal femoral cortex gets thinner. It is the question whether the shape and bone architecture of the proximal femur of patients aged ≥80 years are still suitable for cementless fixation using the cementless stem designs that are currently available. In chapter 5 it was demonstrated that in the elderly current cementless designs in many cases do not offer optimal coronal canal fill. In case one would prefer to use cementless stems in very elderly patients, a specific octo-/nonagenarian cementless stem might be needed which matches more closely with the morphology of the proximal femoral canal in this age group. One could valorize these findings by developing a stem system that scales coronal and sagittal dimensions independently instead of proportional in both planes in order to improve metaphyseal fit in the very elderly, in particular in the sagittal plane.

It was shown in chapter 3 that the position of the femoral head center is different in very elderly people compared to middle-aged people. In the former population it is located in a more mediocaudal position compared to the latter. Therefore, hip stem designs with an extended offset and/or lower caput-collum-diaphyseal (CCD) angle are needed to restore femoral morphology in very elderly patients undergoing hemi or total hip arthroplasty. Some stem systems already offer a broad range of options, such as the cementless Corail stem (Depuy Synthes EMEA, Leeds, United Kingdom) and the

cemented Exeter stem (Stryker Orthopaedics EMEA, Montreux, Switzerland). Other stem systems offer only limited flexibility regarding ML-offset and CCD-angle which forms an opportunity for implant manufacturers to optimize their stem design and size ranges.

After choosing a specific stem design and fixation (either cemented or cementless) orthopaedic surgeons should be aware of the morphological changes of the proximal femur in very elderly patients during the implantation of the stem. Reconstructing the femoral head center at the level of the tip of the greater trochanter may result in excessive leg lengthening and leg length discrepancy (chapter 3 and 4). The latter can potentially result into gait disorders, back pain and patient dissatisfaction which can be an additional burden for healthcare. The latter is in particular true in the United States where leg length discrepancy is the most frequent reason for legal claims after hip arthroplasty. The formulas presented in chapter 4 might be incorporated in software packages intended for pre-operative templating or computer-assisted surgery.

The findings presented in chapter 6 might end the ongoing debate whether cementless stems in hemi hip arthroplasty are suited to treat fractures of the femoral neck. Arguments that previous meta-analyses are not applicable to current practice because they included outdated and discontinued femoral components seem to diminish, because in the current study even an exclusive set of modern cementless stems do not outperform cemented stems regarding (implant-related) complications. Important to address, is the fact that cemented femoral components are proven to be more cost-effective than cementless femoral components. Therefore, the advice to orthopaedic surgeons is to use cemented stems in hemi hip arthroplasty for treatment of femoral neck fractures in very elderly patients.

With cementless fixation growing towards the dominant mode of stem fixation in THA, cementation techniques might become a ‘lost art’. Therefore, cemented THA should be kept part of orthopaedic residency training. Directors of residency programs, orthopaedic societies and the orthopaedic industry are in the position to take the lead in this important process by facilitating educational activities and by routinely demonstrating the value of proper cementation skills. It is desirable to develop clinical guidelines to harmonize treatment practices and to prevent (unnecessary) revision surgery in patients. A scoring system may serve as a decision aid and guide orthopaedic surgeons in the choice for a cementless or cemented femoral component. National joint registries could play a role in making this decision more evidence-based by adding parameters like cortical thickness and femoral canal shape. Large populations may be followed prospectively to investigate the correlations between implant design, fixation method, bone morphology on one hand, and clinical outcome and implant-related complications on the other hand. These evidence based decision making algorithms may lead to faster and better health economical choices.

In summary, this thesis gives important information on how to use femoral components in very elderly patients. It suggests improvements in stem design, stem selection, implantation technique and fixation method. Furthermore it was demonstrated that new developments in a specific field, such as cementless stem designs, do not necessarily lead to better clinical outcomes, although it is presented as such by some involved parties. Implementation of these findings will improve clinical results after hip arthroplasty in very elderly patients which will reduce healthcare costs.